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EPA Region 1 RAC 2 Contract No. EP-S1-06-03

January 12, 2009
Nobis Project No. 80022
NH-2358-2010-D

Via Electronic Submittal

U.S. Environmental Protection Agency, Region 1
Attention: Mr. James DiLorenzo, Task Order Project Officer
5 Post Office Square
Boston, Massachusetts 02109

Subject: Transmittal of Draft Technical Memorandum for Step Drilling Program
Nyanza Chemical Waste Dump – Operable Unit 2
Remedial Investigation
Task Order No. 0022-RA-RA-0115

Dear Mr. DiLorenzo:

Attached with this correspondence is the Draft Technical Memorandum for Step Drilling Program at Nyanza Chemical Waste Dump – Operable Unit 2.

Should you have any questions or comments, please contact me at (603) 724-6238 or JMcCullough@nobisengineering.com.

Sincerely,

NOBIS ENGINEERING, INC.

Jeff McCullough
Sr. Project Manager

Attachment

c: File 80022/MA (w/enc.)

An Employee-Owned Company

Draft Technical Memorandum for Step Drilling Program

Nyanza Chemical Waste Dump - Operable Unit 2
Ashland, Massachusetts

Remedial Action
EPA Task Order No. 0022-RA-RA-0115

REMEDIAL ACTION CONTRACT
No. EP-S1-06-03

FOR

U.S. Environmental Protection Agency
Region 1

BY

Nobis Engineering, Inc.

Nobis Project No. 80022
January 2010

U.S. Environmental Protection Agency
Region 1
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Boston, Massachusetts 02109-3912

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Lowell, Massachusetts
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An Employee-Owned Company

Draft Technical Memorandum for Step Drilling Program

Nyanza Chemical Waste Dump - Operable Unit 2
Ashland, Massachusetts
Remedial Action
EPA Task Order No. 0022-RA-RA-0115

REMEDIAL ACTION CONTRACT
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For
U.S. Environmental Protection Agency
Region 1

By
Nobis Engineering, Inc.

Nobis Project No. 80022

January 2010

Jeff A. McCullough, P.E.
Project Manager

Jeff Brunelle
Project Geologist

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ASHLAND, MASSACHUSETTS

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1.0 INTRODUCTION

Nobis Engineering, Inc. (Nobis) was requested by the U.S. Environmental Protection Agency (EPA) to perform a dense non-aqueous phase liquid (DNAPL) assessment via a step drilling exploration program, redevelop and perform hydraulic testing on existing monitoring wells at the Nyanza Superfund Site, located on Megunko Road in Ashland, Massachusetts (the Site). The area of investigation focused on the previously identified bedrock depression located to the southwest of the existing Worcester Air Conditioning (WAC) building located at 148 Pleasant Street, between MW-113A and the Boston and Albany Railroad right of way (ROW). Additional borings were advanced on the other side of the ROW at the Nyacol property located on Megunko Road, in the grassy area between the historical chemical vault and the ROW.

EPA gave an assignment to construct an extraction well system for DNAPL recovery in support of the Explanation of Significant Differences (ESD). This was based on work previously performed for EPA by the Army Corps of Engineers. In order to identify those areas likely to provide the best DNAPL recovery, EPA technical staff recommended an exploratory drilling program to locate potential DNAPL pools near the bedrock/overburden interface.

Nobis was on the Site for a total of 14 days between September 28 and October 15, 2009 to observe and document drilling, soil screening, and soil characterization activities associated with the advancement of soil borings at the Site. Mr. Jeff Brunelle, Project Geologist, was the Field Operations Lead during Nobis' time on site, and Mr. Carl Thunberg, Senior Engineer, was the active Rig Geologist for the duration of the drilling program. Mr. Jason Fopiano, Project Geologist, was on-site on October 30, 2009 to conduct slug testing on two monitoring wells and oversee disposal characterization sampling of investigation derived waste (IDW) generated during the drilling program. In addition, Mr. James DiLorenzo of the Environmental Protection Agency (EPA), Mr. Jeff McCullough, Nobis Senior Project Manager, Mr. Boyd Allen, Nobis Senior Geologist, and Ms. Laura Bonk, Corporate Health and Safety Officer were at the Site on three different days to observe Site activities.

Field activities were conducted in accordance with the Revised Summary of Monitoring Well Sounding Activities and DNAPL Exploration (Work Scope) submitted to EPA via electronic submittal on December 5, 2008.

2.0 STEPPED DRILLING EXPLORATION PROGRAM

Boart Longyear (Boart) was contracted by Nobis to advance soil and rock borings at the Site. The driller used a Minisonic 100c track mounted drill rig to advance 6-inch outer casing with vibratory-sonic methods. Soil samples were collected by advancing a 4-inch soil sample barrel in 5-foot increments, ahead of the 6-inch casing. The extracted soil samples were deposited into dedicated plastic sleeves and presented to the Rig Geologist for soil classification and screening.

Prior to boring advancement at each location, the drill area was grubbed out, and the drill rig and associated casing and drive rods were steam cleaned at a dedicated decontamination pad located in an isolated area of the Site. The driller then wrapped polyethylene sheeting around the rig tracks once the rig was set-up on each boring location. Following completion of each soil boring, the open borehole was filled from the bottom to the surface with a slurry grout using tremie tube methods unless a monitoring well was installed at the boring location.

Five borings were advanced at the WAC property between September 28 and October 7, 2009, and one boring/monitoring well completed. Two borings were advanced on the Nyacol property on October 14 and 15, 2009. Refer to Figure 1 for the locations of borings advanced during the step drilling program. Photographs taken during field activities are included as Attachment A.

Location B-1 was drilled directly south of MW-113A, adjacent to the railroad ROW on the WAC property. This location was as close to the previously identified bedrock depression as permitted by the ROW and the most logical location for residual DNAPL accumulating along the top of bedrock. Sequential boring locations were selected based on soil conditions observed in previously advanced borings and in accordance with the decision tree included in the Work Scope and in consultation with the EPA TOPO. Borings advancement proceeded in the following sequence:

- B-1, located to the south of MW-113A, along the railroad ROW;
- B-2, located 25 feet west of B-1;
- B-3, located between MW11A and B-2, on the east side of the bedrock fracture trace;
- B-4, located 25 feet east of B-1;
- B-5, located between MW11A and B-4 and 20 feet southeast of MW-113A;

- B-6, located approximately 50 feet east-northeast of SB-600, located on the Nyacol property; and
- B-7, located approximately 40 feet northeast of SB-600, located on the Nyacol property.

2.1 Soil Characterization

During soil sample core recovery, the Rig Geologist logged soil descriptions for each sample sleeve retrieved, noting general soil characteristics including soil grain size, color, strata, amount of soil recovered, and other key components used for soil classification. In general, soil conditions observed at the WAC property consisted of a layer of fill at the surface, followed by outwash sand and gravel, lacustrine silty sand, glacial till, and then bedrock. Bedrock was encountered between 38.5 feet and 43 feet below ground surface (bgs) in borings installed at the WAC property and borings were advanced up to 7.5 feet into bedrock at these locations. Soil conditions encountered in the Nyacol property borings were similar to the WAC borings, except significant outwash soil components were not observed in either of the two borings. Borings at the Nyacol property were advanced up to 1.75 feet into bedrock, beginning at approximately 28 feet bgs.

DNAPL-like odors were detected during boring activities in wash water/groundwater from borings B-1 and MW B-5, but no DNAPL was observed in any of the soils or rock cores recovered from borings advanced at the Site. Boring logs depicting soil conditions observed at each boring location are included as Attachment B. Table 1 summarizes subsurface conditions encountered throughout the Site.

2.2 Soil Screening

Nobis screened soil samples for the presence of volatile organic compounds (VOCs) using a Minirae 2000 Photoionization Detector (PID). The Rig Geologist made a small incision lengthwise along the sample sleeve and screened soils with the PID in 6-inch increments along the length of the sample run.

Elevated PID readings detected in borings conducted at the Site ranged from 5.9 parts per million (ppm) in B-6 to 518ppm in B-5/MW. Refer to Attachment B for PID screening results for each boring/interval. No soil samples were collected for laboratory analysis per the Work Scope.

Because of the hazards posed by the Site contaminants, air in the breathing zone was monitored with Draeger tube sample tubes for health and safety reasons whenever PID screening results exceeded 1.0 ppm. During each Draeger tube sampling event, three different sample tubes capable of detecting nitrobenzene, chlorobenzene, and vinyl chloride were processed using a hand-held Draeger tube pump. None of these compounds was detected above health and safety action levels during Draeger tube screening.

2.3 Monitoring Well Installation

Boring B-5 was completed as a monitoring well. Monitoring well construction consisted of sections of two-inch (inside diameter) thread-coupled, stainless steel riser and 0.01-slot well screen installed across the bedrock contact. A 2-foot sump was installed at the base of the well screen to provide a collection point for any DNAPL entering the well. The driller had difficulty recovering rock cores from the bottom of the borehole while advancing boring B-5, and over-drilled the boring during attempted core recovery. No boulders were encountered during drilling. Total boring depth was 48 feet bgs; however, prior to constructing the well, the driller added rock fragments generated during drilling and bentonite chips to seal the bottom of the boring and bring the depth of the hole up to 46 bgs. The 2-foot sump was installed from 46 to 44 feet bgs, and a 5-foot well screen was installed from 44 to 39 feet bgs, across the bedrock contact at 42 feet bgs. Riser was then installed to bring the well up to the ground surface. The annular space between the well screen and boring was filled with clean #00 silica sand, a bentonite seal installed above the sand pack, with a grout slurry installed to within a foot of the ground surface to prevent vertical water migration along the borehole. A flush mounted road box was cemented in place over the well. Refer to Attachment B for well construction details.

3.0 WELL REDEVELOPMENT AND HYDRAULLIC TESTING

From October 8 to 13, 2009, Nobis was on Site to re-develop existing site monitoring wells MW-113A, RW-1, RWS-1, P-1S, P-1B, P-2, P-4, and the newly installed monitoring well MW B-5 (see Table 2).

Well development consisted of mechanical surging with an inertial pump (Waterra foot valve type pump) driven by a small gasoline engine powered vertical lift machine and/or by over-pumping/surging the well using a submersible electric pump (Whale type pump). Wells were

surged/pumped until purge water was visibly clear, or until a significant volume of purge water was removed from the well. Table 2 summarizes the pumping duration and the estimated quantity of water removed from each well during development. Five pressure transducers were also installed in adjacent wells to identify any hydraulic connection between Site bedrock wells based on pumping response. No immediately observable connection between the bedrock wells was identified using the pressure transducers to monitor water level fluctuation in adjacent monitoring wells during inertial pumping and well development.

4.0 WELL HYDRAULIC TESTING

On October 30, 2009, Nobis performed both rising head and falling head slug tests in monitoring wells MW-113A and B-5. Head data were recorded using a pressure transducer and water level meter during the testing.

4.1 Slug Test Procedures

Rising head slug tests were performed by removing a slug of water from the wells with a four-foot long, 2-inch diameter polyethylene bailer and measuring water levels as they returned to static conditions. Following removal of the slug, water levels were recorded over a 30 minute period every second for the first 5 minutes, every 30 seconds for the next 10 minutes, and then every minute for the final 15 minutes. Usable rising head data were not obtained from B-5 because the water levels recovered too quickly (less than ten seconds) for meaningful measurements.

Falling head slug tests were performed in MW-113A and B-5 by adding a known volume of water to the wells (slug) with a funnel and observing water levels fall back to static conditions. The same incremental time steps used for the rising head test were followed for the falling head tests. Because of the rapid aquifer response observed previously in B-5, the recording duration was shortened to 10 minutes with water levels recorded every second for the first 5 minutes, and every 30 seconds for the final 5 minutes.

4.2 Slug Test Results

Water level responses (changes in head) collected during the slug testing were used to estimate hydraulic conductivities of the surrounding formation(s) using standard analytical techniques and were compared to literature values of similar formations for validation.

Rising head data collected from MW-113A were analyzed using the Bouwer-Rice (1976) methodology yielding a calculated hydraulic conductivity of approximately 7.08×10^{-4} centimeters per second (cm/s) or 2 feet per day (ft/d), comparable with literature values for similar aquifers. Falling head data collected from MW-113A were analyzed also using the Bouwer-Rice approach and yielded a calculated hydraulic conductivity of approximately 8.29×10^{-4} cm/s or 2.35 ft/d.

Falling head data collected from B-5 were analyzed via the Bouwer-Rice slug test method and yielded a hydraulic conductivity of approximately 3.31×10^{-3} cm/s or 9.39 ft/d.

Additionally, the falling head data were analyzed using the Hvorslev-Full Ellipse (1951) slug testing solution for both wells. Results of the calculations yielded hydraulic conductivities of 7.23×10^{-4} cm/s (2.05 ft/d) and 2.62×10^{-3} cm/s (7.43 ft/d) for MW-113A and B-5, respectively, consistent with the Bouwer-Rice interpretations and literature values.

5.0 INVESTIGATION DERIVED WASTE (IDW)

Throughout the investigation, soil, water, and personal protective equipment (PPE) IDW generated during the drilling and well development activities were collected in 55-gallon drums. When filled, the drums were sealed, labeled, and transported, via flatbed truck, to a dedicated drum storage area at the Nyanza Landfill located on Megunko Road. Drums were stored at the locked landfill inside the existing storage shed and in the former concrete containment area located on the north side of the landfill property. The investigation generated 31 drums: 2 PPE, 19 development water, 8 drill water, and 2 soil drums. Also, a small container (5 gallons) of DNAPL product was generated from previous well gaging activities.

ENPRO Services collected waste characterization samples from the IDW drums and DNAPL product container stored at the landfill on October 30, 2009. Preliminary results indicate that the

IDW will be handled as hazardous waste, and Nobis is currently processing the IDW for off-site disposal.

6.0 SUMMARY AND CONCLUSIONS

Nobis and EPA personnel oversaw drilling and well development activities at the Site for a total of 14 days between September 28, 2009 and October 30, 2009.

Seven borings including one converted into a monitoring well were advanced using a Minisonic drill rig at the WAC and Nyacol properties. The boring program started at B-1 located south of MW-113A and adjacent to the railroad ROW, and proceeded in accordance with the decision tree included in the Work Scope for an additional six borings. Soil conditions observed at the WAC property consisted of fill followed sand and gravel, silty sand, glacial till, and then bedrock. Bedrock was encountered between 38.5 feet and 43 feet bgs in borings installed at the WAC property (B-1 through B-5) and at approximately 28 feet bgs at the Nyacol property (B-6 and B-7). The highest elevated PID readings ranged from 5.9 ppm in B-6 to 518 ppm in B-5/MW. During boring activities, although DNAPL-like odors were detected in wash water/groundwater encountered in borings B-1 and B-5/MW, but DNAPL was not observed in any of the new soil borings advanced at the Site.

During redevelopment of monitoring wells MW-113A, RW-1, RWS-1, P-1S, P-1B, P-2, P-4, and B-5/MW, pressure transducers were installed in surrounding wells to try to identify hydraulic connections between Site bedrock wells. Based on transducer data from adjacent wells, no immediately observable connection between bedrock wells was identified from fluctuating water levels during inertial pumping and well development.

Rising and falling head data collected from MW-113A analyzed using Bouwer-Rice methodology yielded a hydraulic conductivity value of approximately 7.08×10^{-4} cm/s (2ft/d) and 8.29×10^{-4} cm/s (2.35 ft/d), respectively.

Falling head data collected from B-5 analyzed using Bouwer-Rice methodology yielded a hydraulic conductivity value of approximately 3.31×10^{-3} cm/s (9.39 ft/d), four times that of MW-113A. Rising head data for B-5 were not usable because of the rapid rate of recovery recorded in the well during testing.

Similar values were obtained using the Hvorslev-Full Ellipse (1951) solution on the falling head data and yielded hydraulic conductivities of 7.23 x 10^{-4} cm/s (2.05 ft/d) and 2.62 x 10^{-3} cm/s (7.43 ft/d) for MW-113A and B-5, respectively.

The investigation generated 31 drums of soil, water, and PPE IDW during Site activities. Based on preliminary results of IDW sampling conducted by the subcontractor, Nobis is currently in the process of identifying hazardous waste disposal facilities for the IDW.

The evaluation of a DNAPL pool in bedrock is a challenging task. DNAPL flow is often characterized by the location, orientation and connectiveness of individual fractures. The absence of an extensive pool of DNAPL suggests B-5/MW is not located in a zone where DNAPL would accumulate. This may be due to interconnectiveness, depth or horizontal position of the well. Another explanation may be that additional time is necessary for the DNAPL to accumulate in the well. It may also suggest that the majority of the DNAPL already has dissipated from the immediate vicinity of the former vault and the bedrock depression area because discharge to the vault ceased approximately four decades ago. The persistent appearance of DNAPL in MW-113A and RW-1 is occasioned when enough DNAPL accumulates and overcomes the entry pressures within the fracture system. When these wells are pumped or sampled, the mass decreases and entry pressure becomes insufficient for further penetration until sufficient mass accumulates again. The limiting factor appears to be the aperture of fractures and the interconnectiveness to any DNAPL pool.

Per the EPA TOPO's direction, an alternate way to find DNAPL using geophysical methods was explored once more. Technical websites were viewed and calls made to several experts. The topic was brought up by EPA's Technical Lead during initial scoping meetings in 2008 and there were no viable technologies at that time. The situation remains the same, 18 months later. All geophysical methods depend on recognizing contrasts – whether it be the difference between material properties like solid vs. liquid phase, physical mass and signal attenuation or geochemical properties like conductivity or resistivity. Although DNAPL and water can be considered to be different phases and can have different densities, there is insufficient contrast for discrimination by available geophysical methods to differentiate between the two materials on top of bedrock or within near surface fractures.

7.0 RECOMMENDATIONS

Based on the results of the step drilling program, DNAPL can be removed from wells MW-113A, RW-1 and potentially at MW B-5 using product pumps with DNAPL level sensors. When enough DNAPL accumulates in the sump, the pump activates, continuing until the low level shut off trips. The time interval between pumping events could range from hours to days depending on the accumulation rates and where the level sensors are set.

Given an assumed DNAPL source to explain the existing dissolved phase groundwater plume, a current summary of contaminant levels in the plume is warranted. The last round of groundwater monitoring and analysis of the OU2 well network (description here) at the Site occurred approximately seven years ago. This sampling data would also support the evaluation if the ongoing vapor mitigation systems currently operating throughout the Town of Ashland and within the existing groundwater plume.

TABLES

Table 1
Subsurface Conditions Summary
Nyanza Chemical Waste Dump - Operable Unit 2
Ashland, Massachusetts

Boring	Fill		Outwash (SP)		Lacustrine (ML)		Till		Bedrock	B.O.B.	GW
	from	to	from	to	from	to	from	to			
B-1	0	7	7	25	25	35	35	42.5	42.5	50	10
B-2	0	7	7	28	28	35	35	43	43	48	10
B-3	0	7.5	7.5	23	23	35	35	38.5	38.5	43.5	10
B-4	0	5.5	5.5	18	18	30	30	41	41	41.5	10
B-5	0	6.5	6.5	23	23	27	27	42	42	48	4.28
B-6	0	17.5	NE	NE	17.5	25	25	27.5	27.5	29	10
B-7	0	18.5	NE	NE	18.5	25	25	28	28	29'-9"	10

Notes:

1. NE means strata not encountered
2. All measurements reflect depth in feet from ground surface existing on the date the explorations were performed.
3. Geologic interpretation of strata was determined by the rig geologist while drilling. Other interpretations may be possible.
4. Strata transitions were estimated based on bag samples recovered during the roto-sonic drilling process. Strata transitions reflect the rig geologist's best judgment based on less than 100% recovery and on observations of disturbed samples.
5. Groundwater observations shown hereon reflect the first observation of saturated soils in the bag samples recovered, except B-5 which shows equilibrated groundwater level readings in the monitoring well installed.
6. B.O.B - Bottom of Boring
7. GW- Groundwater

Table 2
Well Redevelopment Summary
Nyanza Chemical Waste Dump - Operable Unit 2
Ashland, Massachusetts

ID	Date Developed	Start Time	Stop Time	Duration (hr:min)	Gallons Purged	TOS Depth (ft)	BOS Depth (ft)	As-Built Depth (ft)	Measured Depth - Pre Development (ft)	Measured Depth - Post Development (ft)	Description
MW-113A	10/8/09	11:10	12:20	1:10	55	46	50.5	50.52	53.80	54.35	Water clear, DTB greater than as built depth. Solid bottom feel
MW B-5	10/8/09	12:33	14:32	1:59	110	40	46	46.00	47.20	47.35	Water clear, good flow of water. Solid bottom feel.
RW-1	10/8/09	14:40	15:24	0:44	110	36	51	53.11	41.40	42.65	DNAPL observed, strong odor, elevated PID readings, respirators required.
RWS-1	10/9/09	9:00	10:38	1:38	110	na	na	46.00	32.65	34.47	No silt observed, tan water, gravel in bottom clogging ball valve, pump approximately 2 feet off bottom.
P-1S	10/9/09	10:43	13:00	2:17	55	8	18	17.27	16.40	16.60	Low silt observed. Redeveloped with whale pump. Good flow.
P-1B	10/9/09	13:09	15:45	2:36	110	50	53	52.03	41.50	41.70	Good flow, water still silty.
P-1	10/13/09	8:05	9:14	1:09	35	39	42	41.23	19.80	19.98	Tea water, solid bottom feel, good flow.
P-2	10/13/09	12:14	13:35	1:21	20	40.2	43.2	42.33	42.95	42.98	Under trailer, silty brown , low yield, intermittant pumping due to flow. No surging possible.
P-4	10/13/09	9:25	11:58	2:33	275	29.5	32.5	31.83	31.70	32.05	Tea water, solid bottom feel, good flow.

Notes:

1. Measured depths are in feet, measured from the top of the well riser.
2. TOS - Top of screen interval
3. BOS - Bottom of screen interval

FIGURE

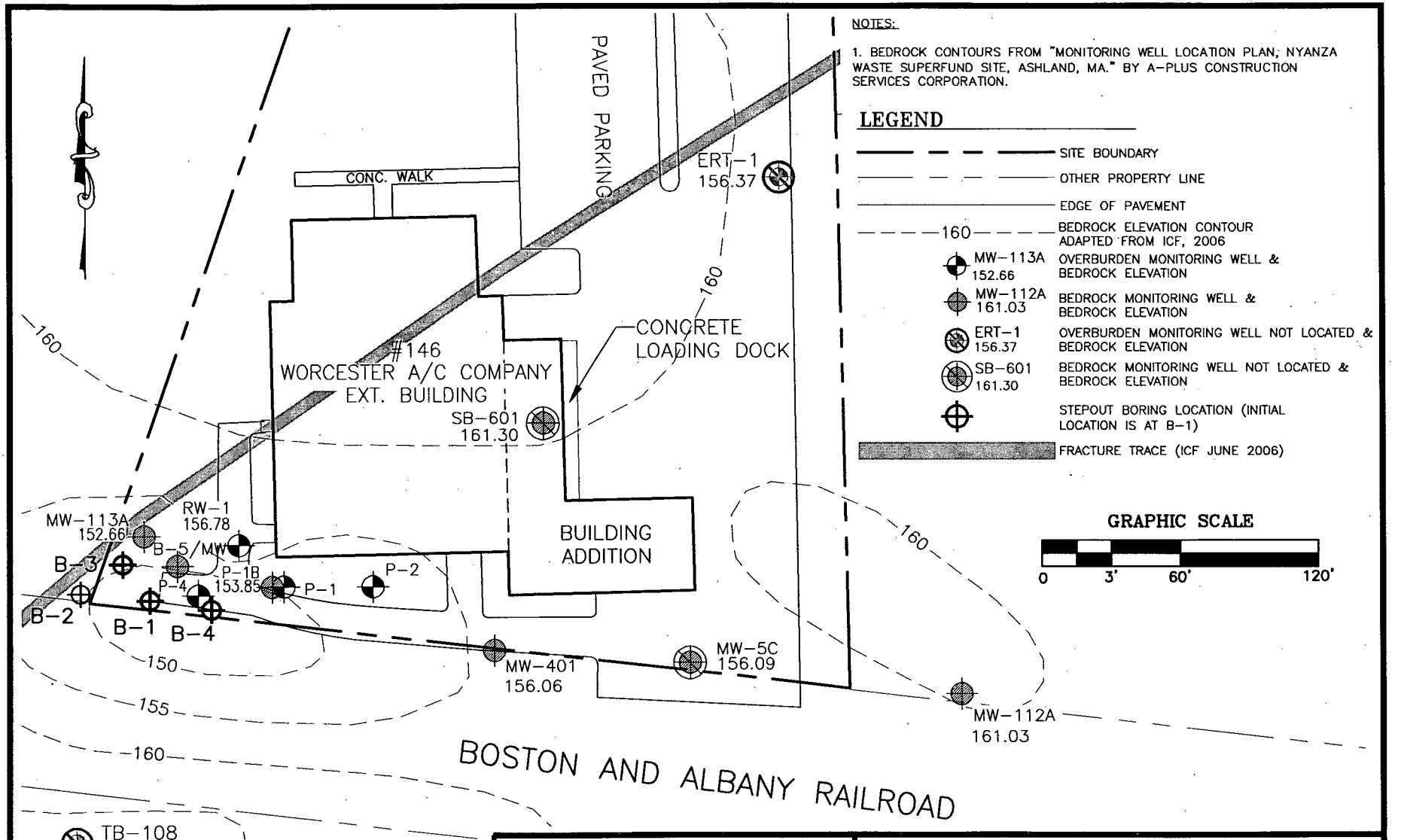

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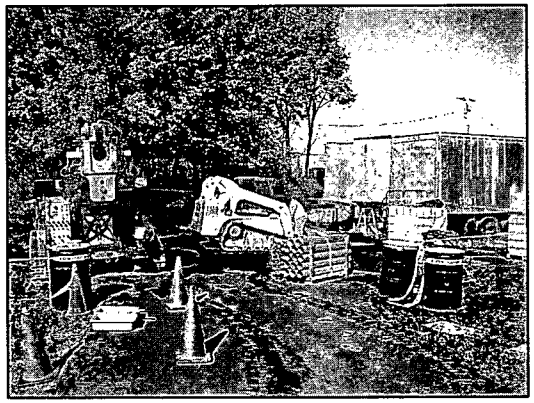
FIGURE 1

BORING LOCATION PLAN
STEP DRILLING PROGRAM
NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE
ASHLAND, MASSACHUSETTS

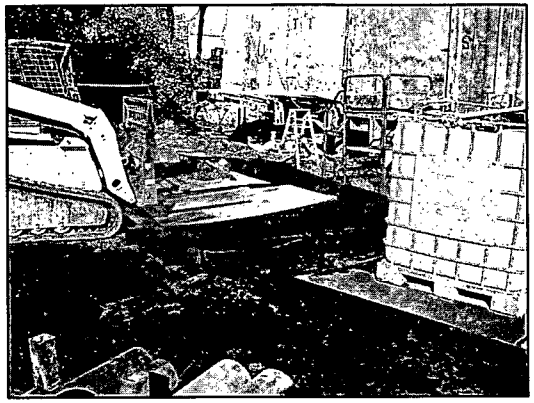
DRAWN BY:	CEL	APPROVED BY:	JM
PROJECT:	80022.07		DECEMBER 2009

R:\80000 Task Orders\80022 Nyanza OU2\CAD\dwg\80022-SITE.dwg

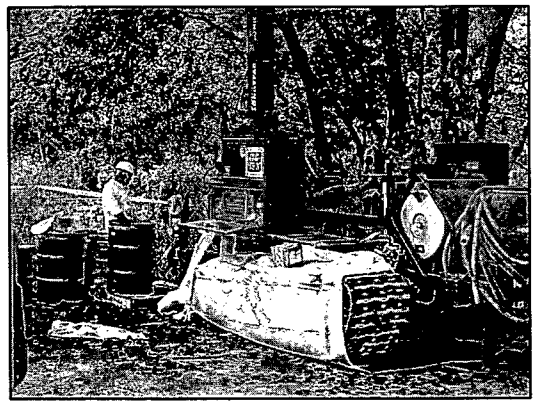
ATTACHMENT A



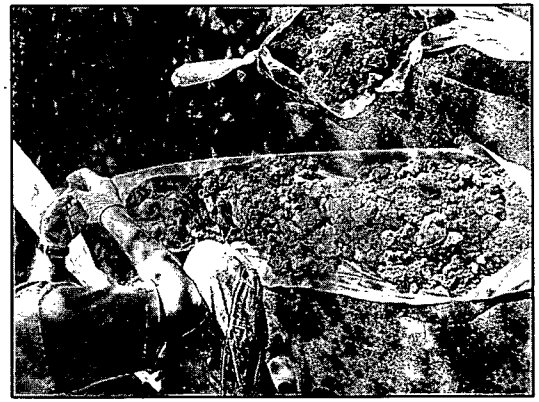
GENERAL VIEW OF WORK ZONE AT WORCESTER AIR CONDITIONING PROPERTY



DECONTAMINATION PAD



BORING LOCATION B-1



TYPICAL VIEW OF ROTO-SONIC SOIL SAMPLE POLY BAG

TYPICAL ROCK CORE RECOVERY

BORING LOCATION B-3

PHOTOGRAPHS TAKEN BY NOBIS ENGINEERING, INC. FROM SEPTEMBER 29 – OCTOBER 15, 2009.

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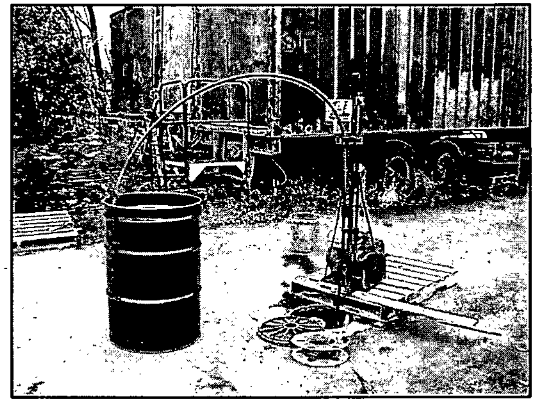
FIGURE A-1

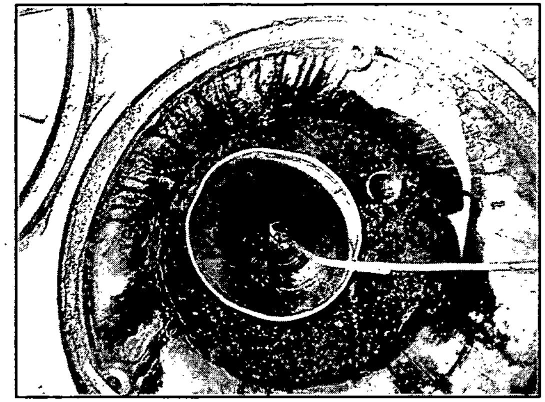
NYANZA CHEMICAL WASTE DUMP
SUPERFUND SITE
OPERABLE UNIT 2 REMEDIAL ACTION
STEP DRILLING PROGRAM
TO 0022-RA-0115

DRAWN BY:	ML	APPROVED BY:	CT
PROJECT:	80022.07	DECEMBER 2009	

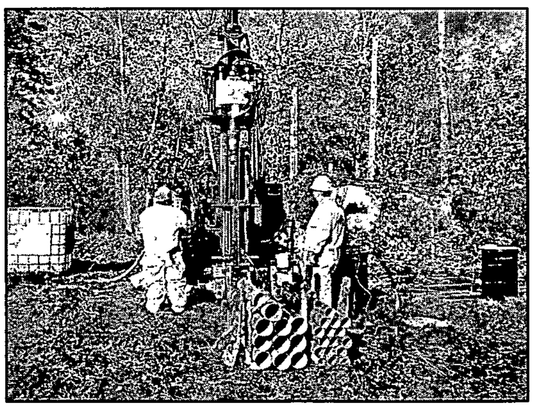
CONSTRUCTING MONITORING WELL AT BORING B-5



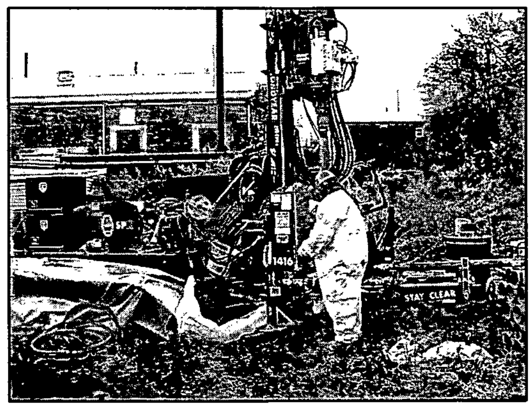
WELL DEVELOPMENT APPARATUS



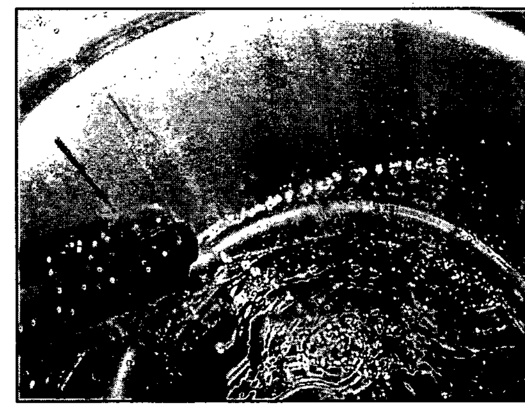
TRANSDUCER INSTALLED IN RW-1, NOTE BENT CASING



BORING LOCATION B-6 ON NYACOL PROPERTY



BORING LOCATION B-7 ON NYACOL PROPERTY



DNAPL RECOVERY MW-113A

PHOTOGRAPHS TAKEN BY NOBIS ENGINEERING, INC. FROM SEPTEMBER 29 – OCTOBER 15, 2009.

Nobis

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FIGURE A-2

NYANZA CHEMICAL WASTE DUMP
SUPERFUND SITE
OPERABLE UNIT 2 REMEDIAL ACTION
STEP DRILLING PROGRAM
TO 0022-RA-0115

DRAWN BY:	ML	APPROVED BY:	CT
PROJECT:	80022.07	DECEMBER 2009	

ATTACHMENT B

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-1
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: September 29, 2009
Date Finish: September 30, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
1	RS-1	18	0-5		1				Organic Soil With Sand, (OL) brown, moist, Heavily rooted forest loam	
2										
3										
4										
5										
6	RS-2	40	5-10		1				Silty Sand With Gravel, (SM) 20 % gravel, brown, wet, Dry at tip of the bag. Screened full length. Upper layer is thinly stratified. Lower portion contains 20% fine to coarse gravel.	
7										
8										
9										
10						▽				
11	RS-3	18	10-15		1				Poorly Graded Sand With Gravel, (SP) 30 % gravel, brown, wet	
12										
13										
14										
15										
16	RS-4	38	15-20		1				Poorly Graded Sand With Gravel, (SP) 10 % gravel, gray, wet, Brown to gray at the bottom.	
17										
18										
19										
20										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-1
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: September 29, 2009
Date Finish: September 30, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
20	RS-5	20	20-25		1					
25	RS-6	40	25-30		1				Sandy Silt, (ML) 70 % fines, olive, wet, Thinly stratified, little gravel observed.	
30	RS-7	3	30-35		1				Sandy Silt, (ML) 3 inches of silt observed.	
35	RS-8	60	35-40						Silty Sand With Gravel, (SM) 30 % fines, gray, Glacial Till. No signs of DNAPL observed. Bedrock estimated at 39.5 feet based on drilling. No visual or olfactory evidence of NAPL noted.	
38					3.7					
39					20.4					
40					28.5					

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\8002207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-1
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: September 29, 2009
Date Finish: September 30, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
	RS-9	30	40-42.5		15.9					
41										
42										
43					0.7				Few fragments of pink granite, coarse grained, containing quartz. biotite and feldspar. Bedrock from 42.5 feet to 50 feet. Bottom of exploration at 50 feet. No visual or olfactory evidence of NAPL noted. Strong "cherry" odor .	
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										

SAMPLE IDENTIFICATION
G - Geoprobe
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U - Undisturbed Sample
R - Core Run

REMARKS:

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-2
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 01, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
1	RS-1	38	0-5		0.2				Sandy Organic Soil With Gravel, (OL) 5 % gravel, brown, dry, Topsoil with olive brown silt observed.	
2										
3										
4										
5										
6	RS-2	60	5-10		1.3				Sandy Organic Soil With Gravel, (OL) 5 % gravel, brown, dry, 24 inches of topsoil.	
7										
8									Poorly Graded Sand With Gravel, (SP)	
9										
10						▽				
11	RS-3	40	10-15		0.7				Poorly Graded Sand With Silt And Gravel, (SP-SM) 20 % gravel, 40 % sand, 10 % fines, brown, wet, Approximately 8 inches of silt at the top of the bag.	
12										
13										
14										
15										
16	RS-4	50	15-20		0.9				Poorly Graded Sand, (SP) 10 % gravel, 10 % sand, brown, wet	
17										
18										
19										
20										

SAMPLE IDENTIFICATION
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U - Undisturbed Sample
R - Core Run

REMARKS:

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-2
Boring Location: See Plan

Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 01, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
	RS-5	4	20-25		1.1				Poorly Graded Sand, (SP) 10 % sand, brown, wet, Poor recovery	
21										
22										
23										
24										
25										
	RS-6	24	25-30		1				Poorly Graded Sand, (SP) brown, wet	
26										
27										
28										
29									Silt With Sand, (ML) 60 % fines, olive brown, wet	
30										
	RS-7	4	30-35		3.5				Silt With Sand, (ML) olive brown, wet, mostly water in the bag. Poor recovery. No visual or olfactory evidence of NAPL noted.	
31										
32										
33										
34										
35										
	RS-8	50	35-40		16				Poorly Graded Sand With Silt And Gravel, (SP-SM) 5 % gravel, 5 % sand, 10 % fines, gray, wet, Estimating tip of the rock surface at 39.5 feet. No visual or olfactory evidence of NAPL noted.	
36										
37										
38										
39										
40					28.5					

SAMPLE IDENTIFICATION
G - Geoprobe
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U - Undisturbed Sample
R - Core Run

REMARKS:

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-2
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 01, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
41	RS-9	60	40-45		10.1				Poorly Graded Sand With Silt And Gravel, (SP-SM) Similar to previous sample No visual or olfactory evidence of NAPL noted.	
42										
43									Bedrock from 43 feet to 48 feet. Bottom of exploration at 48 feet. No visual or olfactory evidence of NAPL noted.	
44										
45										
46	RS-10	36	45-48							
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-3
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 02, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
1	RS-1	24	0-5		1				Organic Soil, (OL) brown black, moist, Poor recovery 24 inches. Topsoil/loam over sand and gravel with roots.	
2										
3										
4										
5										
6	RS-2	48	5-10		0.1				Organic Soil, (OL) brown black, moist, 12 inches of topsoil.	
7										
8									Sandy Silt, (ML) 60 % fines, brown, wet	
9										
10						▽				
11	RS-3	38	10-15		0.1				Poorly Graded Sand With Gravel, (SP) 5 % gravel, 10 % sand, 5 % fines, brown, wet	
12										
13										
14										
15										
16	RS-4	48	15-20		0.1				Poorly Graded Sand With Gravel, (SP) 30 % gravel, brown, wet	
17										
18										
19										
20										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-3
Boring Location: See Plan

Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 02, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
21	RS-5	60	20-25		0.2				Poorly Graded Sand, (SP) 50 % sand, brown, wet, 18 inches of poorly graded sand followed by 14 inches of gravel layer mostly fine gravel.	
22										
23										
24									Silty Sand, (SM) 40 % fines, olive brown, wet	
25										
26	RS-6	60	25-30		0.1				Silty Sand, (SM) 5 % gravel, 25 % fines, olive brown, wet, Possible glacial till (soil structure disturbed -angular gravel observed)	
27										
28										
29										
30										
31	RS-7	0	30-35		0.1				No recovery .	
32										
33										
34										
35										
36	RS-8	21	35-38.5		22				Silty Sand, (SM) No evidence of DNAPL.	
37										
38										
39	RS-9	0	38.5-43.5						Bedrock from 38.5 feet to 43.5 feet. No visual or olfactory evidence of NAPL.	
40										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-3
Boring Location: See Plan

Checked by: J. Brunelle
Date Start: October 01, 2009
Date Finish: October 02, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
41									Bottom of exploration at 43.5 feet.	
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\8002207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-4
Boring Location: See Plan

Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 05, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▼					

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
1	RS-1	18	0-5		1				Organic Soil With Gravel, (OL) dark brown, moist, Topsoil	
6	RS-2	60	5-10		1				Organic Soil With Gravel, (OL) dark brown, moist Silty Sand, (SM) 30 % fines, brown, moist	
8									Silty Sand With Gravel, (SM) 20 % gravel, 15 % fines, brown, dry	
11	RS-3	16	10-15		1.1				Poorly Graded Sand, (SP) brown, wet, trace silt observed.	
16	RS-4	60	15-20		1				Poorly Graded Gravel With Sand, (GP) 60 % gravel, brown, wet	
17									Poorly Graded Sand, (SP) 10 % sand, brown, wet	
18									Silty Sand, (SM) 60 % fines, olive brown, wet, Dilatancy quick.	

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. **B-4**
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 05, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽					

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
	RS-5	60	20-25		2				Silty Sand, (SM) 60 % fines, olive brown, wet	
21										
22										
23										
24										
25										
	RS-6	60	25-30		4.5				Silt, (ML) 70 % fines, olive brown, wet, Thinly stratified.	
26										
27										
28										
29										
30										
	RS-7	60	30-35		8.3				Poorly Graded Sand With Silt, (SP-SM) 5 % gravel, 5 % sand, 10 % fines, wet, Probable till. No indication of DNAPL.	
31										
32										
33										
34										
35										
	RS-8	60	35-40		43				Poorly Graded Sand With Silt, (SP-SM) 5 % gravel, 5 % sand, 10 % fines, wet, Distinct pungent odor, but no visual indication of NAPL.	
36										
37										
38										
39										
40										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-4
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 05, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽					

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
	RS-9	18	40-41.5						Poorly Graded Sand With Silt, (SP-SM) 5 % gravel, 5 % sand, 10 % fines, wet	
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\8002207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-5
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 06, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽					
		4.28			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	WELL DETAIL	REMARKS
1	RS-1	34	0-5		1				Organic Soil With Sand, (OL) dark brown, moist, Topsoil.		
2											
3											
4											
5						▽			Silt, (ML) 70 % fines, olive brown, wet		
6	RS-2	44	5-10		1				Organic Soil, (OL) dark brown, wet, Fill.		
7									Silty Sand, (SM) brown, wet		
8									Silty Sand, (SM) brown, dry		
9											
10											
11	RS-3	24	10-15		1				Poorly Graded Sand, (SP) 10 % sand, brown, wet		
12											
13											
14											
15											
16	RS-4	24	15-20		1				Poorly Graded Sand With Gravel, (SP) 20 % gravel, brown, wet		
17											
18											
19										Cement Grout	
20											

SAMPLE IDENTIFICATION
G - Geoprobe
S - Split Spoon
U - Undisturbed Sample
R - Core Run

REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:47 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-5
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 06, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽					
		4.28			

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	Stratum: Log	Stratum: Elev./ Desc.	Sample Description (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	Well Detail	Remarks
	RS-5	48	20-25		1				Poorly Graded Sand With Gravel, (SP) 20 % gravel, brown, wet		
21											
22											
23											
24											
25									Silt, (ML) 60 % fines, olive brown, wet, Stratified.		
	RS-6	48	25-30		1				Silt, (ML) 60 % fines, olive brown, wet		
26									Poorly Graded Sand With Silt, (SP-SM) 10 % fines, brown, wet		
27											
28											
29											
30											
	RS-7	30	30-35		12				Poorly Graded Sand, (SP) brown, wet		
31											
32											
33											
34											
35											
	RS-8	60	35-40		1				Poorly Graded Sand With Silt, (SP-SM) 10 % fines, brown, wet, Glacial till. No visual or olfactory evidence of NAPL noted.	Bentonite seal	
36											
37											
38										2 in. stainless steel slotted pipe encased in filter sand.	
39											
40											

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Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-5
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 05, 2009
Date Finish: October 06, 2009

Contractor: Boart Longyear
Driller: K. Regan
Nobis Rep.: C Thunberg

Rig Type / Model: BLY Mini-Sonic
Hammer Type: N/A
Hammer Hoist: N/A

Ground Surface Elev.:
Top-of-Riser Elev.:
Datum: NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽					
		4.28			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	WELL DETAIL	REMARKS
41	RS-9	24	40-43		518				Poorly Graded Sand With Silt, (SP-SM) 10 % fines, brown, wet Strong pungent odor and high PID readings. No visual evidence of NAPL noted.		
42											
43											
44	RS-10	60	43-47								
45											
46											
47										Bentonite seal	
48										Rock fragments	
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-6
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 14, 2009
Date Finish: October 14, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 In.	PID	Ground Water	Stratum: Log	Stratum: Elev./ Desc.	Sample Description (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	Remarks
1	RS-1	36	0-5		1				Organic Soil With Sand, (OL) 12 inches of Topsoil.	
2									Silty Sand, (SM) moist, Fill	
3									Silty Sand, (SM) dark brown black, wet, trace gravel observed.	
4										
5										
6	RS-2	22	5-10		1				Silty Sand, (SM) dark brown black, wet	
7										
8										
9										
10						▽				
11	RS-3	18	10-15		1				Poorly Graded Sand, (SP) 10 % sand, dark brown, wet, trace silt observed.	
12										
13										
14										
15					5.9					
16	RS-4	60	15-20		1				Poorly Graded Sand, (SP) 10 % sand, dark brown, wet	
17										
18									Silt, (ML) 60 % fines, olive brown, wet, Stratified. Aprubt transition from sand to silt. Inferred bottom of fill depth at 17.5 ft.	
19										
20										

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REMARKS:

BOREHOLE LOG - NOBIS ENGINEERING.GDT - 11/24/09 13:40 - R:\80000 TASK ORDERS\80022 NYANZA OU2\TECHNICAL DATA (TD)\BORING LOGS\80022207 BORING LOGS.GPJ

Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-6
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 14, 2009
Date Finish: October 14, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	Stratum: Log	Stratum: Elev./ Desc.	Sample Description (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	Remarks
	RS-5	0	20-25		1				Liquified silt turned to liquid mud. No recovery.	
21										
22										
23										
24										
25										
	RS-6	24	25-29		1				Poorly Graded Sand With Silt, (SP-SM) 10 % fines, gray, wet No visual or olfactory evidence of NAPL noted.	
26										
27										
28									Approximately 6 inches of rock core recovered. Bedrock type is granite. No visual or olfactory evidence of NAPL noted.	
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-7
Boring Location: See Plan
Checked by: J. Brunelle
Date Start: October 15, 2009
Date Finish: October 15, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽		10.0			

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
1	RS-1	36	0-5		1				Organic Soil With Sand, (OL) Topsoil	
2									Poorly Graded Sand With Silt, (SP-SM)	
3					50				Poorly Graded Sand With Gravel, (SP) dark brown black, moist, Distinct odor observed.	
4										
5										
6	RS-2	60	5-10		157				Poorly Graded Sand With Gravel, (SP) gray, moist	
7					107					
8					15				Poorly Graded Sand, (SP) 10 % gravel, 10 % sand, dark brown, moist, Bottom 18 inches. Exhibit sewage odor.	
9										
10						▽				
11	RS-3	60	10-15		13				Poorly Graded Sand, (SP) gray, wet	
12										
13					1				Poorly Graded Sand, (SP) 20 % gravel, 70 % sand, dark brown black, wet, trace fine gravel observed.	
14										
15										
16	RS-4	60	15-20		1				Poorly Graded Sand, (SP) 20 % gravel, 70 % sand, dark brown black, wet	
17										
18										
19									Silty Sand, (SM) 60 % fines, olive brown, wet, No signs of stratification observed. No visible indication of NAPL	
20										

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REMARKS:

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Nobis Engineering, Inc.

PROJECT

Nyanza Superfund Site OU2
Ashland, Massachusetts

Nobis File No:. 80022.07

Boring No:. B-7
Boring Location: See Plan

Checked by: J. Brunelle
Date Start: October 15, 2009
Date Finish: October 15, 2009

Contractor:	Boart Longyear	Rig Type / Model:	BLY Mini-Sonic	Ground Surface Elev.:	
Driller:	K. Regan	Hammer Type:	N/A	Top-of-Riser Elev.:	
Nobis Rep.:	C Thunberg	Hammer Hoist:	N/A	Datum:	NGVD

	Drilling Method	Sampler
Type	Mini-Sonic	Poly Bag
Size	4	
Advancement	Sonic	

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▼		10.0			

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft)	Blows/ 6 in.	PID	Ground Water	STRATUM Log	Elev./ Desc.	SAMPLE DESCRIPTION (Soil: ASTM D2488 Visual Manual Procedure As Modified by Nobis)	REMARKS
	RS-5	20	20-25		1				Silty Sand, (SM) 30 % fines, olive brown, poor recovery. Bag contained mostly water.	
21										
22										
23										
24										
25										
	RS-6	36	25-29.83						Poorly Graded Sand With Gravel, (SP) 18 inches of sand and gravel . No visual or olfactory evidence of NAPL noted.	
26										
27									Silty Sand With Gravel, (SM) Till. No visual or olfactory evidence of NAPL noted.	
28										
29									No visual or olfactory evidence of NAPL noted.	
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

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